

REMARKS

This Amendment is responsive to the Office Action mailed May 18, 2007. After entry of this Amendment, claims 1, 3, 6-8, 10, and 12-20 are pending in this application and subject to examination. Claims 2, 4, 5, 9, and 11 are cancelled. Claim 1 is amended to incorporate the subject matter of cancelled claims 2, 4, 5, 9, and 11. No new matter has been added.

Reconsideration of the application as amended is respectfully requested in view of the following remarks.

Rejection Under 35 U.S.C. § 112, First Paragraph

Claims 19 and 20 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Specifically, the Examiner alleges that while (1) the specification and drawings show and describe a bottom evaporator and (2) the specification discloses maintaining the reaction mixture in the boiling state in the reaction zone, maintenance of the reaction mixture in the boiling state in the reaction zone by the bottom evaporator is not disclosed. *See* page 2, ¶ 3 of the May 18, 2007 Office Action. Applicants respectfully traverse.

The subject matter of a claim need not be described literally or “*in ipsius verbis*” in order for the specification to satisfy the written description requirement. *See, e.g., Cordis Corp. v. Medtronic Ave., Inc.*, 339 F.3d 1352, 1364 (Fed. Cir. 2003); *In re Lukach*, 442 F.2d 967, 969 (CCPA 1971). It is sufficient that the specification convey clearly to those skilled in the art the information that applicant has invented the specific subject matter claimed. *See, e.g., In re Wertheim*, 541 F.2d 257, 262 (CCPA 1976); *In re Ruschig*, 379 F.2d 990, 996 (CCPA 1967). Applicants respectfully direct the Examiner’s attention to page 9, lines 1-11 and page 9, line 37 to page 10, line 7 of the present specification. In particular, page 9, lines 37-39 of the present specification states that “[a]dvantageously, the **reaction** is carried out in such a way that reaction mixture **below** the reaction zone is **evaporated** to obtain a mixture of liquid and gaseous reaction mixture.” Persons of ordinary skill in the art would understand this to mean that liquid reaction

mixture below the reaction zone is evaporated (*i.e.*, boiled) into the reaction zone above, where it is maintained as a mixture of liquid and gaseous reaction mixture. Persons of ordinary skill in the art would also understand that such evaporation could be achieved by using a bottom evaporator. As such, Applicants believe that the present specification contains sufficient written description to support claims 19 and 20.

Applicants respectfully request withdrawal of this rejection.

Rejection Under 35 U.S.C. § 102(b)

Claims 1-6, 8, 9, 11-13, 15, and 17 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,439,041 to Gey et al. (hereinafter, "Gey"). Claims 1-6, 8-13, 15, and 17 stand rejected 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,957,876 to Rapoport et al. (hereinafter, "Rapoport"). Applicants believe that neither Gey nor Rapoport teach every limitation of claim 1, as amended, and thus respectfully traverse this rejection.

Gey teaches a process for recovery of cyclohexanol and cyclohexanone from oxidation reaction products containing these components together with water, cyclohexane, and byproduct acids and esters of cyclohexanol (reaction mixture) by (1) separating water of reaction containing adipic acid from the organic phase, (2) neutralizing the organic phase with dilute aqueous caustic solution, (3) distilling the neutral reaction product to remove cyclohexane, cyclohexanone, and cyclohexanol from the mixture, and (4) treating the remaining mixture with caustic to saponify the remaining esters and recover additional cyclohexanol. *See* Abstract of Gey. Gey teaches that the reaction mixture can be prepared in the reactor illustrated in Figure 2. There, 11 is a reactor wherein cyclohexane, entering by way of line 13, is subjected to countercurrent contact with air which is supplied by line 15 through lines 18, 20, and 22, which define three oxidation stages in the reactor. Unreacted gases, containing cyclohexane vapors, leave reactor 11 by way of line 42. In condenser 44, normally liquid components are converted back to liquid form for return by line 46 to the reactor 11. Reaction product leaves the bottom of reactor 11 via line 70. *See* Figure 2 and column 4, lines 50-62 of Gey. However, this reactor is not a rectification column. Indeed, reaction mixture, which consists predominantly of cyclohexanol, cyclohexanone, water, and

unreacted cyclohexane, is not subject to distillation until later on in the process, after it has been phase-separated and treated with caustic, as described above. *See e.g.*, distillation columns 141 and 204 in Figure 1 of Gey. Thus, the oxidation process taught in Gey is not a reactive distillation.

Rapoport teaches a process for oxidizing cyclohexane to a product fluid consisting essentially of unreacted cyclohexane, cyclohexanone, cyclohexanol, and cyclohexyl hydroperoxide. *See* column 2, lines 14-17 of Rapoport. The process involves oxidizing cyclohexane in a series of zones wherein cyclohexane is fed downwardly through the zones and an oxidizing gas is passed upwardly through the zones. *See* column 2, lines 19-23 of Rapoport. The tower oxidizer (22) of Figure 1 is disclosed as a suitable apparatus for this process. At the top of tower oxidizer (22), cyclohexane enters through a port (24) and off-gas is removed through a second port (25). The tower oxidizer is divided into 21 zones (1-21) by trays that each contain apertures through which the oxidizing gas passes on its way up the tower. Oxidizing gas may be fed to any or all of the first 18 trays (*See, e.g.*, 26-40). Outlet port (44) is used to continuously remove product from the reactor, while inlet (42) is used to introduce recycled off-gas. *See* Figure 1 and column 4, lines 1-54 of Rapoport. Like the reactor of Gey discussed above, this reactor is also not a rectification column. This is supported by the fact that the majority of unconverted cyclohexane is withdrawn at the bottom of the reactor through outlet port (44) together with cyclohexanol and cyclohexanone. *See e.g.*, Example 1 in Table 1 of Rapoport, which demonstrates that of 530 parts by weight of cyclohexane fed to the reactor per hour, only 90 parts by weight per hour of cyclohexane is released in the off-gas. The majority of unreacted cyclohexane is present in the 440 parts by weight of reaction product withdrawn at the reactor bottom. Thus, the oxidation process taught in Rapoport is not a reactive distillation.

In contrast claim 1, as amended, recites a process for oxidizing a starting material with an oxidizing agent to obtain a product which comprises

carrying out the oxidation in a reaction apparatus which has
a bottom region at the lower end,

a top region at the upper end and
a reaction zone between the top region and the bottom region,
maintaining the reaction mixture in the boiling state in the reaction zone, and
introducing oxidizing agent into the reaction zone in at least two substreams;
wherein unconverted starting material leaving the reaction zone is recycled into said
reaction zone;
wherein said oxidizing agent is a molecular oxygen-containing gas;
wherein said reaction apparatus is a rectification column; and
wherein a product-containing reaction mixture is withdrawn below the reaction zone.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *See* MPEP § 2131, citing *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Claim 1, as amended, requires that the recited reaction apparatus be a rectification column. As pointed out above, neither of the reactors of Gey or Rapoport are rectification columns. Thus, since both Gey and Rapoport fail to either expressly or inherently teach every element of amended claim 1, this claim is not anticipated by either of these references. Furthermore, since claims 3, 6, 8, 10, 12, 13, 15, 17 all depend, either directly or indirectly, from claim 1, which is deemed novel and patentable, these dependent claims are likewise novel and patentable over Gey and Rapoport. Since claims 2, 4, 5, 9, and 11 are cancelled, this rejection is moot as to these claims.

Applicants respectfully request withdrawal of this rejection.

Rejection Under 35 U.S.C. § 103(a)

Applicants incorporate by reference herein in their entirety the above remarks pertaining to amended claim 1.

Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as obvious over Gey alone or in view of Rapoport and Hawley's Condensed Chemical Dictionary, 12th ed., 1993, p. 1139 (hereinafter, "Lewis"). The Examiner asserts that (1) Gey teaches all of the limitations of these claims except for "the use of 20-40 theoretical plates in their rectification column," but that (2), in view of the teachings of Rapoport and Lewis, persons of ordinary skill in the art would have found the use of as many as 100 theoretical plates in the reactor of Gey to be obvious. *See* page 4, ¶ 10 of the May 18, 2007 Office Action. Applicants respectfully traverse.

As with establishing anticipation, to establish *prima facie* obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art. *See* MPEP § 2143.03 (citing *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). Claim 1, as amended, requires that the recited reaction apparatus be a rectification column. As pointed out above, neither of the reactors of Gey or Rapoport are rectification columns. As such, even the combined teachings of these references fail to teach or suggest use of a rectification column. Furthermore, the Examiner relies on Lewis for the definition of "theoretical plate" and the statement that as many as 100 theoretical plates are used in laboratory or industrial operations, but fails (1) to show how combining the teaching of Lewis with those of Gey and Rapoport results in the modification of the Gey and Rapoport reactors into rectification columns and (2) to provide any motivation for such a combination. Thus, since Gey, alone or in combination with Rapoport and Lewis, fails to teach or suggest every element of amended claim 1, this claim is non-obvious over these references, alone or in combination. Furthermore, since claims 3, 6, 8, 10, 12, 13, 15, 17 all depend, either directly or indirectly, from claim 1, which is deemed non-obvious and patentable, these dependent claims are likewise non-obvious and patentable over these references alone or in combination. Since claims 2, 4, 5, 9, and 11 are cancelled, this rejection is moot as to these claims.

Applicants respectfully request withdrawal of this rejection.

In view of the above amendment and remarks, Applicants believe the pending application is in condition for allowance.

The Director is authorized to charge \$460.00 to Deposit Account No. 03-2775, under Order No. 12810-00027-US1, to cover the extension fee required by 37 C.F.R. § 1.17(a)(2). Should any other fees be required in connection with this Amendment, authorization is hereby made to charge any fees due or outstanding, including any extension fees, or credit any overpayment, to Deposit Account No. 03-2775, under Order No. 12810-00027-US1 from which the undersigned is authorized to draw.

Dated: October 18, 2007

Respectfully submitted,

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